AC Servo System

Frequency Response **3.0**kHz

Quick Set-up Guide

AMP & MOONS' Automation

Important Notice

Disclaimer

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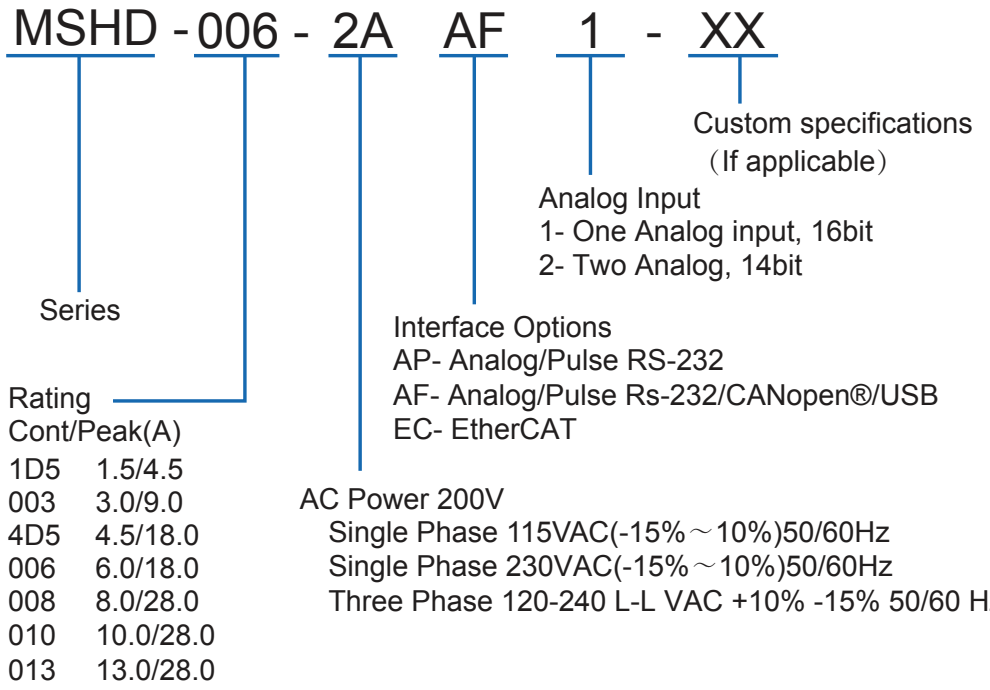
Part Number

For ordering the MSHD, refer to the following diagram:



Contents

Safety

Only qualified persons may perform the installation procedures. You do not need to be an expert in motion control to install and operate the drive system. However, you must have a basic understanding of electronics, computers, mechanics, and safety practices.

The MSHD utilizes hazardous voltages.
Be sure the drive is properly grounded.

Before you install the MSHD, review the safety instructions in this manual. The manual is available as a PDF file that can be downloaded from the MOONS' website.

Failure to follow the safety instructions may result in personal injury or equipment damage.

Preparation

Hardware

The following hardware is required for installation.

- Mating connectors and the associated crimp pins for interfaces P1, P2, P3, and P4 (all models) and P5 (only for MSHD-008, MSHD-010 and MSHD 013).
- Mating connectors for interfaces C2, C3 and C4:
    - Connector C2 (Controller I/O):
      Plug 3M 10136-3000PE and shell 3M 10336-52F0-008
    - Connector C3 (Machine I/O):
      Plug 3M 10120-3000PE and shell 3M 10320-52F0-008
    - Connector C4 (Motor Feedback):
      Plug 3M 10126-3000PE and shell 3M 10326-52F0-008
- Wires for connectors:
    - Connector P1: 26–28 AWG for all models.
    - Connectors P2, P3, and P4:
      18 AWG – for MSHD-1D5 and MSHD-003
      16 AWG – for MSHD-4D5 and MSHD-006
      14 AWG – for MSHD-008, MSHD-010 and MSHD-013
    - Connector P5 (only for MSHD-008, MSHD-010 and MSHD-013): 16 AWG
    - Connectors C2 (Controller I/O), C3 (Machine I/O) and C4 (Motor Feedback): 24–28 AWG.
- Crimping tools, if you are not using ready-made cable assemblies:
    - Connector P1: Molex crimper 0638190000
    - Connectors P2, P3, P4, P5: JST crimper YRF-1070.
      If a crimp pin extraction tool is needed, use JST extraction tool EJ JFAJ3.
- M4 ring or spade terminal.
- A small slotted screwdriver for setting the drive address switches.
- For connection to the host computer, use one of the following:
    - USB 2.0 A to Mini-B cable (USB interface)
    - 4p4c plug and cable (RS232 interface)

Computer System

The following computer system and software are required:

- 2 GHz CPU
- 1 MB RAM
- 1000 MB available on hard drive (after .net 4 is installed)
- USB port for connecting to the drive
- Operating system: Windows XP-SP3, or Windows 7
- ServoStudio, the graphical software interface for configuring and testing the drive. Download from the MSHD product page on the Servotronix website.
- .Net4 (for details, refer to .NET Framework System Requirements). If .NET 4 is not installed on the computer, ServoStudio will guide you through the installation, but will not install it automatically.

Installation Overview

Perform the following steps to install and setup a MSHD system. The steps are described in detail in the following pages (See figure below).

1. Mount the MSHD.
2. Connect the motor to P2.
3. Connect safe torque off (STO) to P1, or use jumpers to bypass.

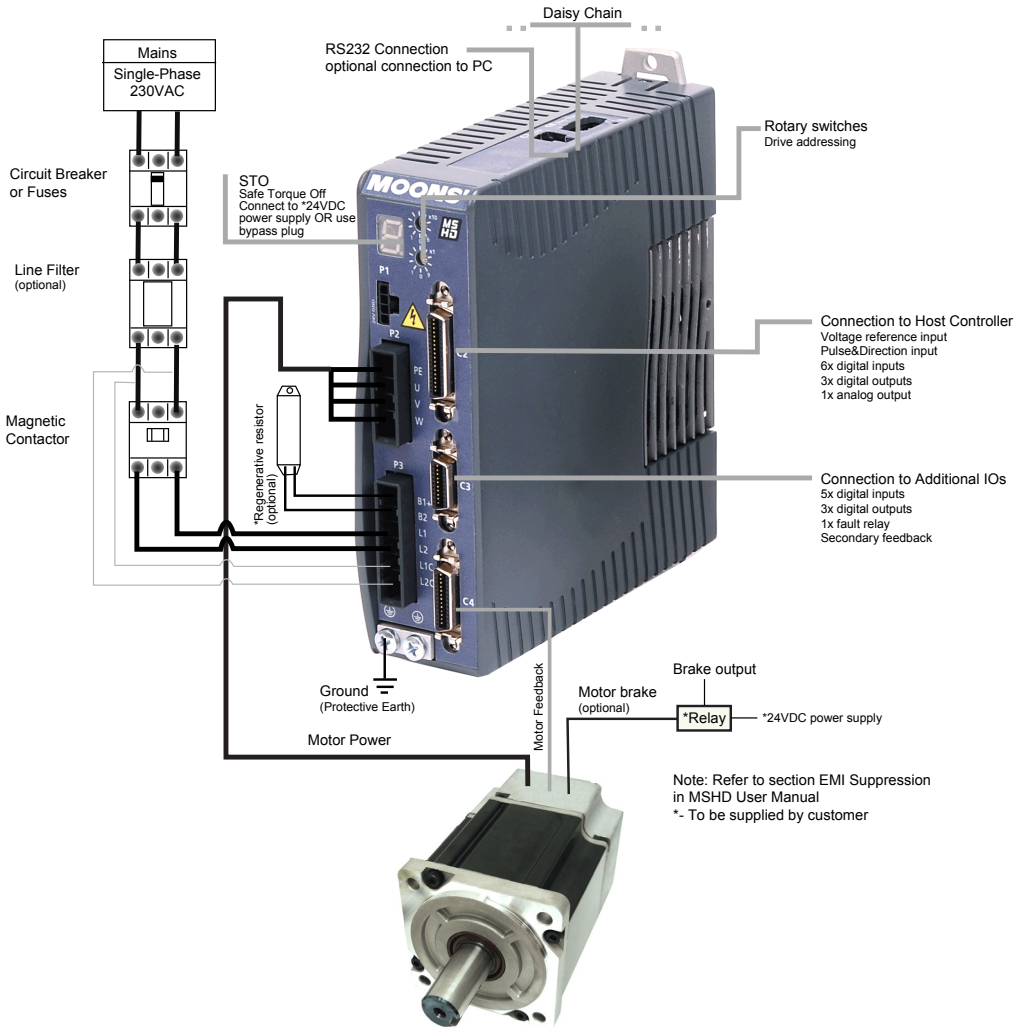
   Refer to Step 3. Connect STO.
4. Connect regen resistor to pins B1+ and B2 on P3, if required.
5. Connect motor feedback to C4.
6. Connect machine I/Os to C3 and/or controller I/Os at C2.
7. Connect AC input voltage.

   Note: This interface varies among models.

   Refer to Step 8. Connect AC Input Voltage.
8. Set the drive address using the rotary switches.
9. Connect the drive to the PC.
10. Power up the drive and the PC.
11. Install ServoStudio software.
12. Using ServoStudio, configure and test the drive.

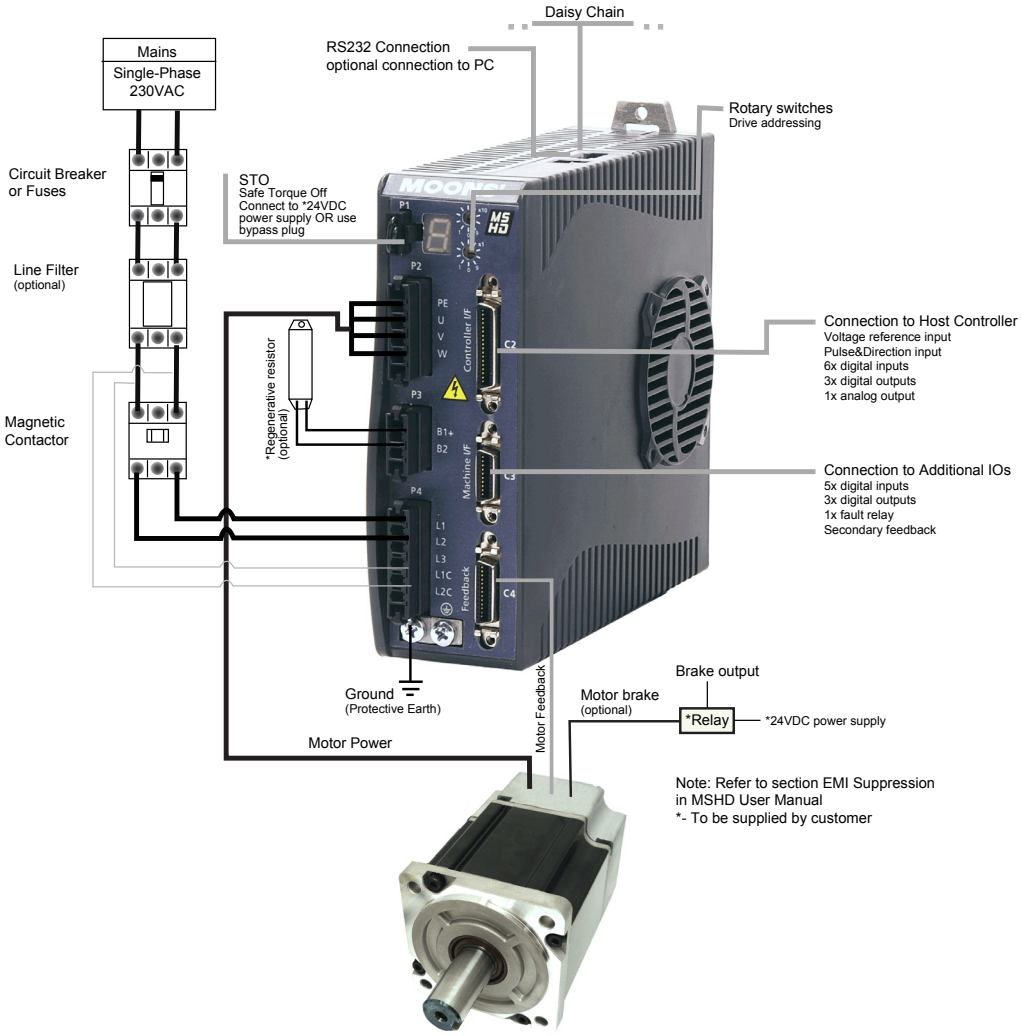
MSHD Servo System Wiring

Using single-phase 230 VAC



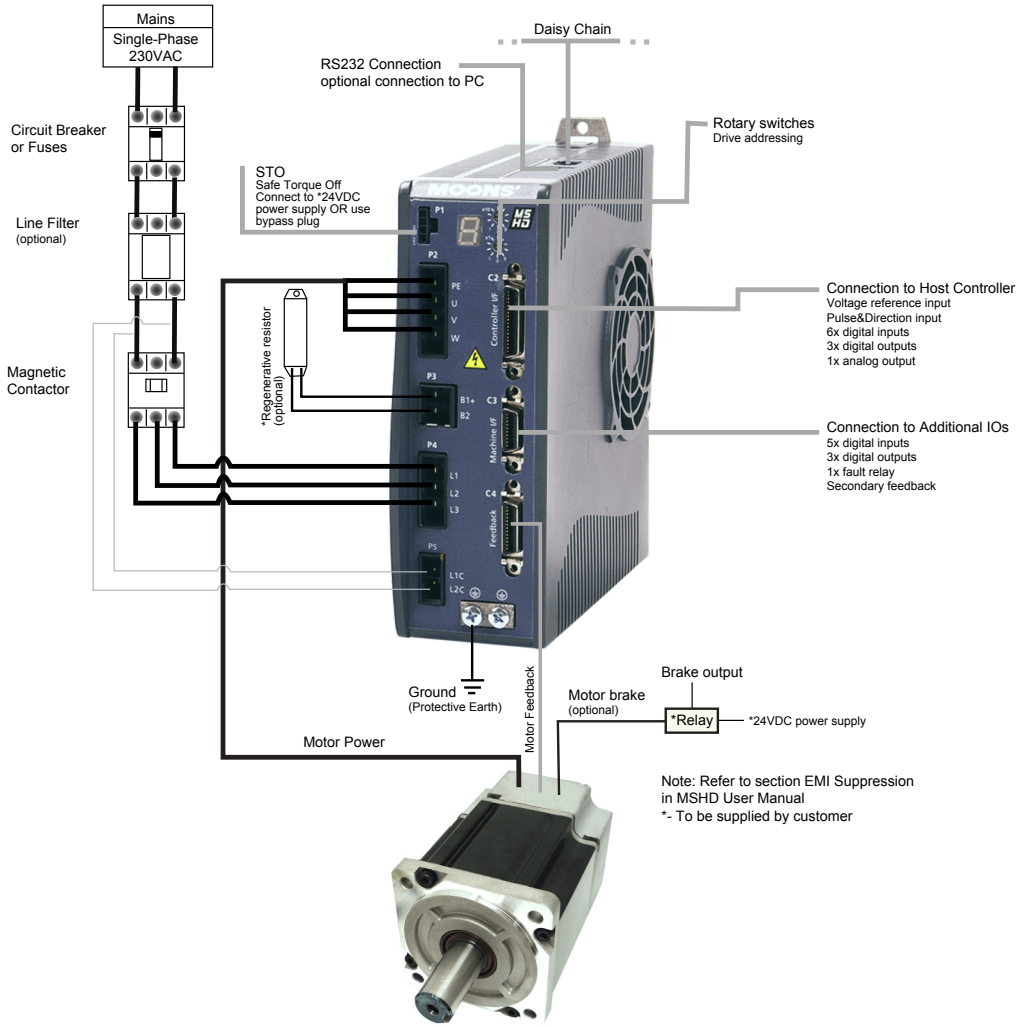
⚠ AC supply for the main power input(L1 L2) and for the logic power input(L1C L2C) must be from the same AC phase input, as show in the diagram.

MSHD-1D5/MSHD-003 Servo System Wiring, Single-Phase 230 VAC



⚠ AC supply for the main power input(L1 L2) and for the logic power input(L1C L2C) must be from the same AC phase input, as show in the diagram.

MSHD-4D5/MSHD-006 Servo System Wiring, Single-Phase 230 VAC

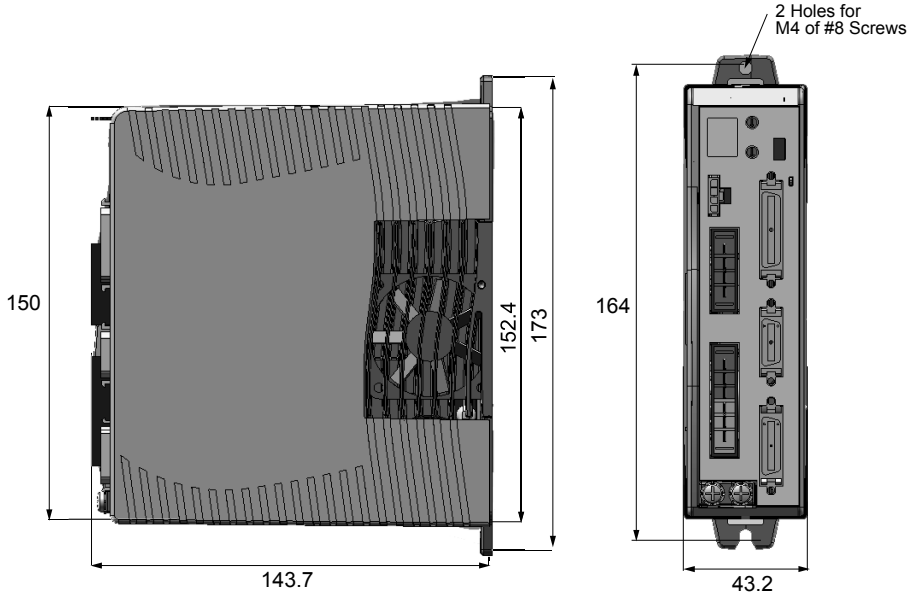


AC supply for the main power input(L1 L2) and for the logic power input(L1C L2C) must be from the same AC phase input, as show in the diagram.

MSHD-008/MSHD-010/MSHD-013 Servo System Wiring,
Three-Phase 230 VAC

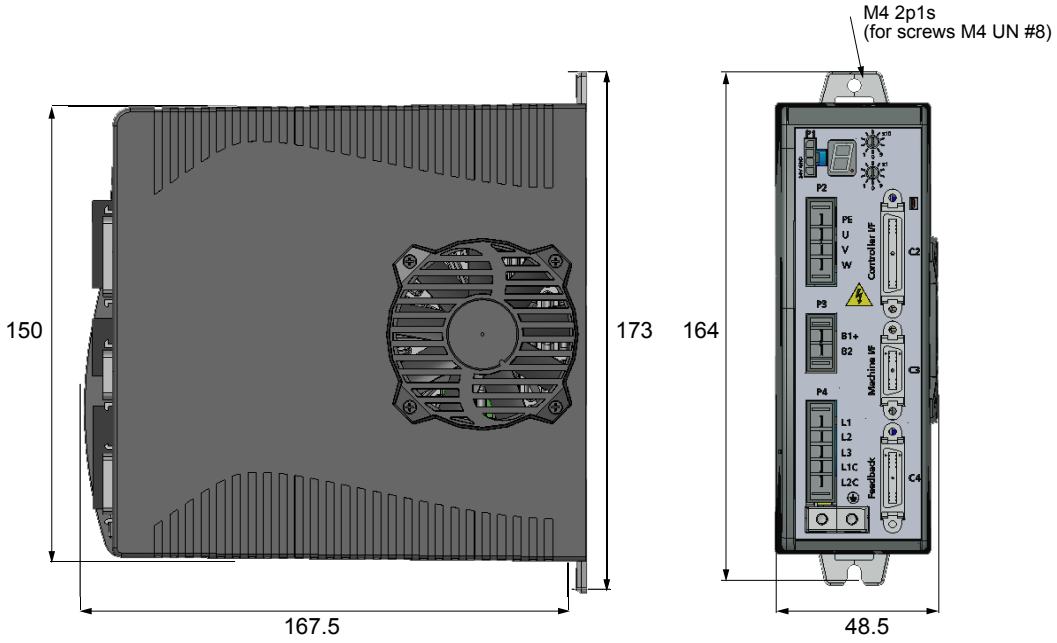
Step 1 Mount the MSHD

Using the bracket on the back of the MSHD, mount the MSHD on a grounded conductive metal panel.

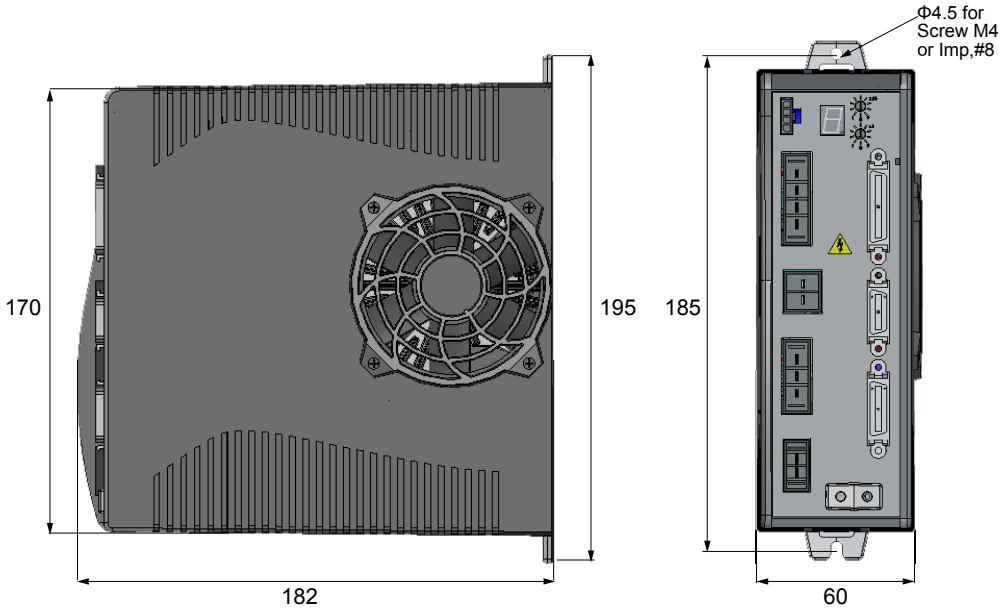


MSHD-1D5/MSHD-003 Dimensions (in mm)

Note: MSHD-1D5 does not have fan.



MSHD-4D5/MSHD-006 Dimensions (in mm)



MSHD-008/MSHD-10/MSHD-013 Dimensions (in mm)

Step 2 Connect Motor

Motor uses interface P2 on all MSHD models.

Connect the motor interface.

Motor Interface

Pin	Pin Label	Function
1	PE	Protective ground (motor housing)
2	U	Motor Phase U
3	V	Motor Phase V
4	W	Motor Phase W

Step 3 Connect STO

STO uses interface P1 on all MSHD models.

Safe torque off (STO) is a safety function that prevents the drive from delivering power to the motor, which can generate torque.

STO Enable and STO Return must be connected to enable MSHD operation. The

STO Enable signal voltage must be 24 VDC.

Connect the STO interface.

Note: If the application does not require STO control, jumper pin 4 to pin 1, and pin 3 to pin 2, to bypass the STO.

STO Interface

Pin	Pin Label	Function
1	24V	STO Enable
2	GND	STO Return
3		24V Return, provided by the drive for use with emergency stop circuit
4		24V Supply, provided by the drive for use with emergency stop circuit

Step 4 Connect Regen

Regen uses interface P3 on all MSHD models.

Note: On models MSHD-1D5 and MSHD-003, Regen and AC Input Voltage are combined on one connector.

If the application requires a regeneration (regen) resistor, use the P3 interface.
Connect the regen resistor between terminals B1+ and B2.

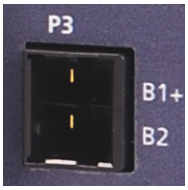


Table 3-5. Regen Interface

Pin	Pin Label	Function
1	B1+	DC bus +
2	B2	Regen bus -

Step 5 Connect Motor Feedback

Motor Feedback uses interface C4 on all MSHD models.

Wire the motor feedback interface according to the type of feedback device to be used in your application. Refer to the guidelines following the pinout table below.

Pins 1, 2, 14 and 15 have dual functionality.

Pin 25 for the motor temperature sensor is connected internally in the drive to MSHD ground.
Unused pins must remain unwired.

Motor Feedback Interface

Pin	Function	Pin	Function
1	Incremental encoder A + or SSI encoder data +	11	5V supply
2	Incremental encoder B + or SSI encoder clock +	12	Motor temperature sensor
3	Incremental Encoder Z +	13	5V supply
4	Hall U +	14	Incremental encoder A - or SSI encoder data -
5	Hall W +	15	Incremental encoder B - or SSI encoder clock -
		16	Incremental encoder Z -
		17	Hall V+
		24	Ground
		25	Motor temperature sensor
		26	Shield

Wiring Guidelines

- For incremental encoder with Halls, use pins 1, 14, 2, 15, 3, 16, 4, 17, 5, 11, 12, 24, 25, 26

Step 6 Connect Controller I/Os

Controller I/Os uses interface C2 on all MSHD models.

Wire the digital and analog inputs and outputs according to the requirements of your application.

Wire the digital and analog inputs and outputs according to the requirements of your application. Unused pins must remain unwired.

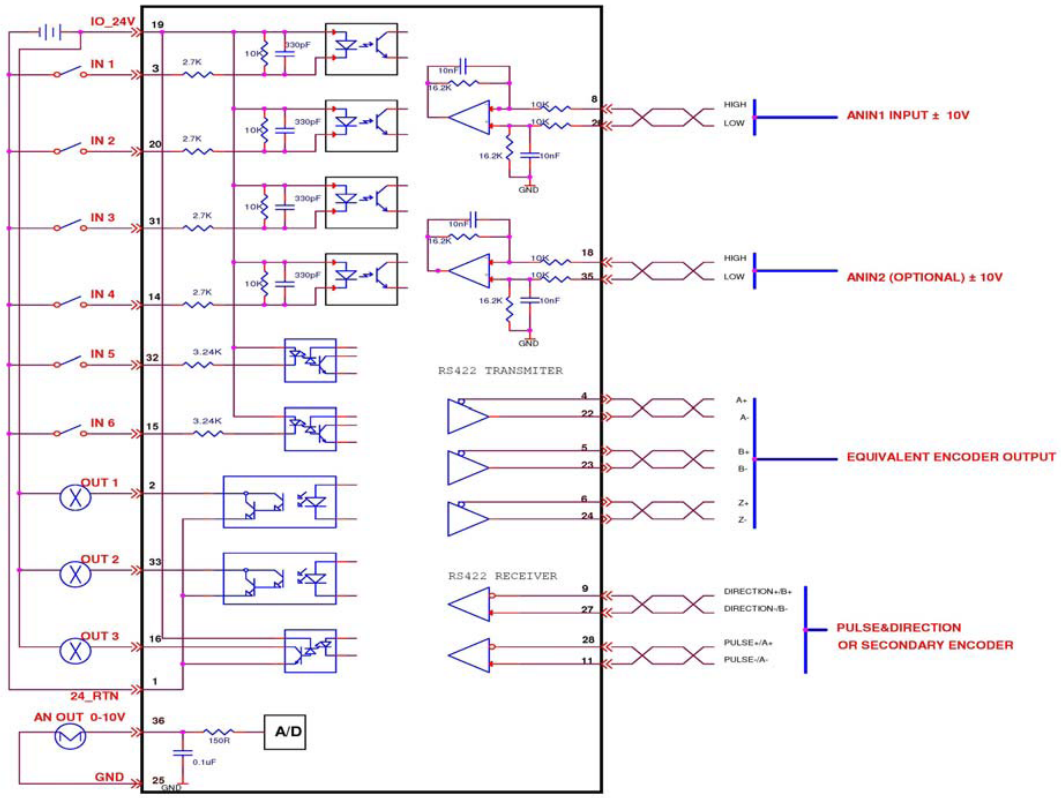
To preserve isolation of the digital I/Os, connect a 24 VDC source to pin 19. Connect the return of the 24 VDC supply to pin 1, which functions as the ground path for the outputs.

Note: The 24 VDC supply and return can be connected on either the Controller interface (C2) or the Machine interface (C3), but it is not necessary to connect it on both.

Controller I/O Interface

Pin	Function	Description	Pin	Function	Description
1	24 VDC return	Return of the user-supplied 24 VDC	19	24 VDC	User supplied 24V, for I/O biasing
2	Digital output 1	Opto-isolated programmable digital output. Read using OUT1	20	Digital input 2	Opto-isolated programmable digital input. Read using IN2
3	Digital input 1	Opto-isolated programmable digital input. Read using IN1	21		Reserved for future use
4	Equivalent encoder output A-	ALow side of the equivalent encoder output signal (RS422)	22	Equivalent encoder output A+	High side of the equivalent encoder output signal A (RS422)
5	Channel B- out	Low side of the equivalent encoder output signal B (RS422)	23	Channel B+ out	High side of the equivalent encoder output signal B (RS422)
6	Channel Z- out	Low side of the equivalent encoder output index (RS422)	24	Channel Z+ out	High side of the equivalent encoder output index (RS422)
7		Reserved for future use	25	Ground	Digital ground
8	Analog input 1+	High side of the differential analog command input (±10 VDC)	26	Analog input 1-	Low side of the differential analog command input (±10 VDC)
9	Direction input+	High side of the direction signal (RS422), or High side of the master encoder signal B, or High side of the down count signal	27	Direction input-	Low side of the direction signal (RS422), or Low side of the master encoder signal B, or Low side of the down count signal
10	Ground	Digital ground	28	Pulse input+	High side of the pulse signal (RS422), or High side of the master encoder signal A, or High side of the up count signal
11	Pulse input-	Low side of the pulse signal (RS422), or Low side of the master encoder signal A, or Low side of the up count signal	29	Ground	Digital ground
12		Reserved for future use	30		Reserved for future use
13	Ground	Digital ground	31	Digital input 3	Opto-isolated programmable digital input. Read using IN3
14	Digital input 4	Opto-isolated programmable digital input. Read using IN4	32	Digital input 5	Fast opto-isolated programmable digital input. Read using IN5
15	Digital input 6	Fast opto-isolated program-mable digital input. Read using IN6	33	Digital output 2	Opto-isolated programmable digital output. Read using OUT2
16	Digital output 3	Fast opto-isolated program-mable digital output. Read using OUT3	34		Reserved for future use
17		Reserved for future use	35*	Analog input 2-	Low side of the second differential analog input (±10 VDC)
18*	Analog input 2+	High side of the second differential analog input (±10 VDC)	36	Analog output	Analog output, referenced to digital ground (0-10 VDC)

Controller Interface Wiring



Step 7 Connect Machine I/Os

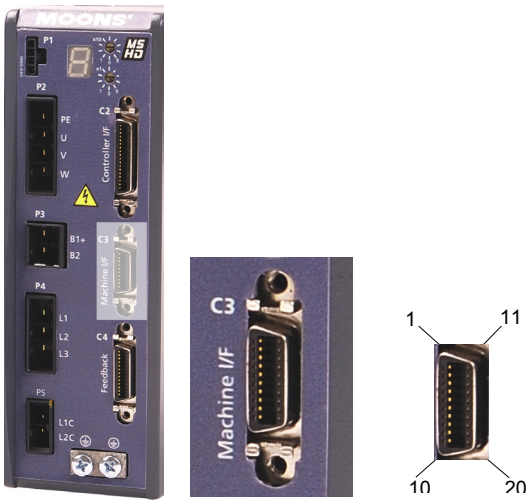
Machine I/Os uses interface C3 on all MSHD models.

Wire the machine inputs and outputs according to the requirements of your application.

Unused pins must remain unwired.

To preserve isolation of the digital I/Os, connect a 24 VDC source to pin 9. Connect the return of the 24 VDC supply to pin 19, which functions as the ground path for the outputs.

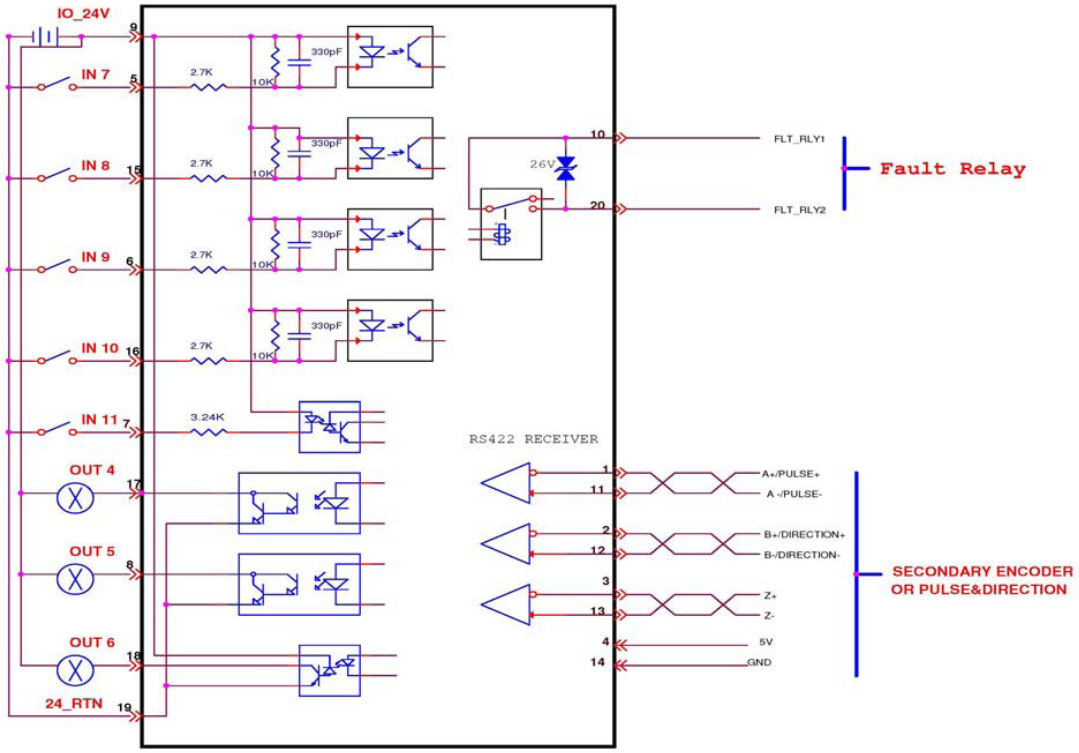
Note: The 24 VDC supply and return can be connected on either the Controllerinterface (C2) or the Machine interface (C3), but it is not necessary to connect it to both.



Machine I/O Interface

Pin	Function	Description	Pin	Function	Description
1	Secondary encoder A+	High side of the secondary encoder input signal A (RS422), or High side of the pulse signal	11	Secondary encoder A	Low side of the secondary encoder input signal A (RS422), or Low side of the pulse signal
2	Secondary encoder B+	High side of the Secondary encoder input signal B (RS422), or High side of the direction signal	12	Secondary encoder B-	Low side of the secondary encoder input signal B (RS422), or Low side of the direction signal
3	Secondary encoder Z+	High side of the secondary encoder input index (RS422)	13	Secondary encoder Z-	Low side of the secondary encoder input index (RS422)
4	Secondary encoder 5V	5 VDC supply for the secondary encoder	14	Secondary encoder ground	Ground of the 5 VDC supply for the secondary encoder.
5	Digital input 7	Opto-isolated programmable digital input. Read using IN7	15	Digital input 8	Opto-isolated programmable digital input. Read using IN8
6	Digital input 9	Opto-isolated programmable digital input. Read using IN9	16	Digital input 10	Opto-isolated programmable digital input. Read using IN10
7	Digital input 11	Fast opto-isolated programmable digital input. Read using IN11	17	Digital output 4	Opto-isolated programmable digital output. Read using OUT4
8	Digital	Opto-isolated programmable digital output. Read using OUT5	18	Digital output 6	Fast opto-isolated programmable digital output. Read using OUT6
9	output 5	User supplied 24V, for I/O biasing	19	24 VDC return	Return of the usersupplied 24 VDC
10	Fault relay 1	Terminal 1 of the dry contact fault relay	20	Fault relay 2	Terminal 2 of the dry contact fault relay

Machine Interface Wiring



Step 8 Connect AC Input Voltage

Note: The AC Input interfaces and connectors vary among MSHD models.

- MSHD-1D5 and MSHD-003: One connector for bus power and logic power uses interface P3.
- MSHD-006: One connector for bus power and logic power uses interface P4.
- MSHD-013: Two connectors – a connector for bus power uses interface P4, and another connector for logic power uses interface P5.

Make the following connections:

1. Connect L1, L2 and L3 (for bus power).
    - If the main voltage is from a single-phase source, connect line and neutral to L1 and L2.
    - If the main voltage is from a three-phase source, connect the phases to L1, L2 and L3.
2. Connect the AC input voltage ground wire to the PE terminal, located on the MSHD front panel. Use an M4 ring or spade terminal.

3. Connect L1C and L2C (for logic power).
    - If the main voltage is from a single-phase source, connect line and neutral to L1C and L2C.
    - If the main voltage is from a three-phase source, connect any two phases to L1C and L2C.

Make sure the main voltage rating matches the drive specification. Applying incorrect voltage may cause drive failure.

Make sure that the AC supply for the main power input (L1 and L2), and the logic power input (L1C and L2C) are from the same AC phase input, as shown in Figure 3-2.

Do not apply power until all hardware connections are complete.

AC Input Voltage Interface

Note: On models MSHD-1D5 and MSHD-003, Regen and AC Input Voltage are combined on one connector. Since these models support only singlephase AC, they do not have a L3 terminal for bus power.

MSHD-1D5 MSHD-003	**Pin**	**Pin Label**	**Function**
P3	3	L1	AC Phase 1
	4	L2	AC Phase 2
	5	L1C	Logic AC Phase 1
	6	LC2	Logic AC Neutral
MSHD-4D5 MSHD-006	**Pin**	**Pin Label**	**Function**
P4	1	L1	AC Phase 1
	2	L2	AC Phase 2
	3	L3	AC Phase 3
	4	L1C	Logic AC Phase 1
	5	LC2	Logic AC Neutral
MSHD-008 MSHD-010 MSHD-013	**Pin**	**Pin Label**	**Function**
P4	1	L1	AC Phase 1
	2	L2	AC Phase 2
	3	L3	AC Phase 3
P5	1	L1C	Logic AC Phase 1
	2	LC2	Logic AC Neutral

Step 9 Set the Drive Address

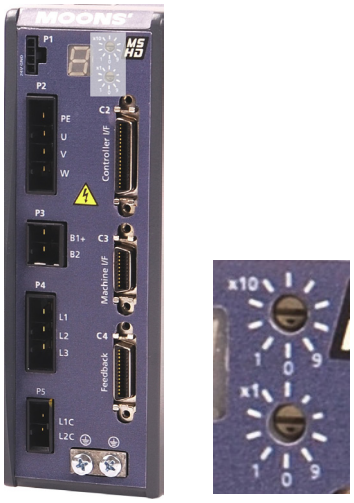
Use the two rotary switches to set the drive address for both CAN and serial communication.

For Ethernet-based motion buses, the switch has no functional use for either the drive or the network. It can be used at the application level to identify specific drives on a network.

Each switch has 10 positions:

- The upper switch positions are set as tens: 10, 20, 30 … 90
- The lower switch positions are set as ones: 0, 1, 2 … 9

Note: If two or more drives are connected to the network, address 0 cannot be used. A singular drive may have the address 0.



Step 10 Connect to PC

To connect the drive to the host computer, use either one of the following interfaces:

- USB port. The interface is labeled C1 on all MSHD models. Use a USB 2.0 A to Mini-B cable.

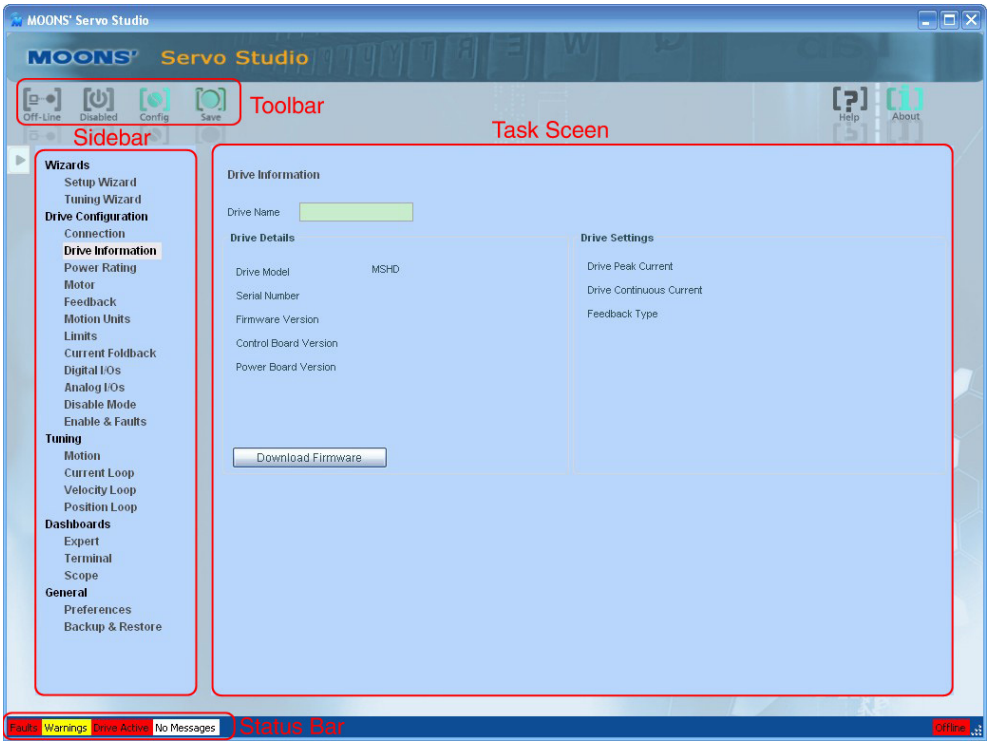
- RS232 port. The interface is labeled C7 on all MSHD models. Use a 4p4c plug.

RS232 Interface – 4P4C

Pin	Pin Label	Function
1	RX	Receive
2	GND ISO	Ground
3	TX	Transmit
4		Unused

Step 11 Install ServoStudio Software

1. Install ServoStudio software on the host computer.
2. When installation is complete, start ServoStudio from the Windows Start menu or the shortcut on your desktop.



Step 12 Power Up

1. After completing the hardware connections, turn on power to the drive.

Note: If logic and bus AC supplies are separate, it is recommended that logic AC be turned on before bus AC.

2. The first time the drive is connected to the host computer on the USB port, Windows detects the device and displays a Found New Hardware wizard.

Browse to and select the Drivers folder. The path will vary, depending on the computer's operating

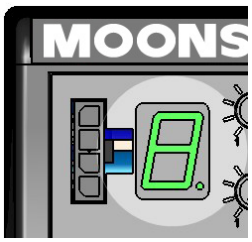
system and the location selected for software installation; for example:

- \Program Files (x86)\\ServoStudio\Drivers
- \Program Files\\ServoStudio\Drivers

The wizard will automatically select and install the driver file STX-MSHD.inf from the folder.

3. Look at the 7-segment display on the MSHD front panel.

   Upon initial power up, the status display shows a flashing e, indicating a Parameter Memory Checksum Failure. This fault will be cleared once the drive is configured and the parameters are saved in the drive's non-volatile memory.



The digital display provides various indications of drive operation, such as operation modes, drive enable status, and fault conditions.

For more information, refer to the section Drive Status 7-Segment Display.

Step 13 Configure the Drive

1. In ServoStudio, select the Setup Wizard option from the navigation menu.
2. Follow the prompts to configure the MSHD for your particular motor and application.

Note: The wizard performs a basic drive configuration. For more advanced configuration options and procedures, refer to the MSHD User Manual.

Drive Status

The 7-segment display provides various indications of drive status, such as operation modes, drive enable status, and fault conditions.

The display uses the following conventions:

- Decimal point –Enable/Disable status; if displayed, the drive is enabled.
- Steadily lit digit – Operation mode (OPMODE).
- Steadily lit letter – Warning.
- Sequential display of letters and digits – Fault.

Other Status Indications

- During the motor setup (At1) and current loop tuning (At2) procedures, three characters are displayed in sequence.
- During the encoder initialization, a digit flashing at half-second intervals indicates the operation mode (OPMODE) currently in effect.

Normal Operation Codes

After the drive is configured and ready for operation, the display shows a steadily lit single digit, indicating the operation mode.

Display	Name	Description
.		Drive enabled
0	OPMODE 0	Serial velocity control
1	OPMODE 1	Analog velocity control
2	OPMODE 2	Serial current control
3	OPMODE 3	Analog current control
4	OPMODE 4	Master/slave gearing control
8	OPMODE 8	Position control
E	Ember Mode	Drive is in Ember mode; firmware is being downloaded to the drive.

Warning Codes

Warning conditions are indicated by one steadily lit character.

Display	Warning Name	Description	Action Required
F	Foldback	Drive average current exceeds rated drive continuous current. Current foldback is active.	Check the drive-motor sizing. This warning can occur if the drive is under-sized (under-powered) for the application.
t	Over-Temperature	The temperature on the power board and/or on the control board has exceeded the preset limit.	Check if the ambient temperature exceeds the drive specification. Otherwise contact technical support.
u	Under-Voltage	The bus voltage is below the minimum value.	Check that the main AC voltage supply is connected to the drive and is switched on. Verify that the setting of UVMODE is correct.

Fault Codes

Fault conditions are indicated by one flashing character, or a sequential display of multiple characters.

The following table will help you interpret the fault codes, and respond appropriately.

- **Display** is the code that appears on the drive's 7-segment display.
- **Fault** Name is the text message displayed in ServoStudio.
- **A D** indicates whether the **Active** Disable (controlled stop) function can be triggered by the fault. (NA indicates Not Applicable.)

Display	Fault Name	Description	A D	Action Required
=	Watchdog Fault	Generally occurs due to an unforeseen circumstance. The drive is inoperable until power is cycled.	No	Contact technical support.
-1	Not Configured	Drive configuration required.	NA	Set drive parameters and execute CONFIG.
-5	Motor Setup Failed	Motor Setup procedure failed (MOTORSETUPST will show the reason)	No	Check phase and motor wiring. Make sure to choose the correct feedback type. And follow the clues given in MOTORSETUPST.
-6	Current Loop Autotune Failed	One of the steps in the Current Loop Autotune process has failed.	No	Check CLTUNEST for the failed step.
A4	CAN Supply Fault	A problem with the internal voltage supply for the CANbus.	Yes	The drive probably needs repair. Contact technical support.
b	Drive Locked	Security code and key do not match. Fatal fault; drive cannot be operated.	NA	Contact technical support.
b1	PLL (phase-locked loop) Synchronization Failed	Controller synchronization signal is missing or not stable. The fault is detected only when synchronization is enabled by SYNCSOURCE command.	No	Check if controller provide synchronization signal. Check the cable connection and wiring.
C1	CAN Heartbeat Lost	Drive identified a disconnection in CAN master/drive connection.	Yes	Reconnect master/slave connection and power cycle the drive.
e	Parameter Memory Checksum Failure	The non-volatile memory used to store drive parameters is empty or the data is corrupted.	NA	Reconfigure the drive, or download the parameter set, and save the parameters.
E	Failure Writing to Flash Memory	An internal problem accessing the flash memory. Fatal fault; drive cannot be operated.	NA	Contact technical support.
e101	FPGA Config Fail	The code for the FPGA did not load. Fatal fault; drive cannot be operated.	NA	Contact technical support.
e105	Self Test Fail	The power-up self test failed. Fatal fault; drive cannot be operated.	NA	Contact technical support.
e106	Digital EEPROM Fault	A problem accessing the EEPROM on the digital board. Fatal fault; drive cannot be operated.	NA	Contact technical support.
e107	Power EEPROM Fault	A problem accessing the EEPROM on the power board. Fatal fault; drive cannot be operated.	NA	Contact technical support.

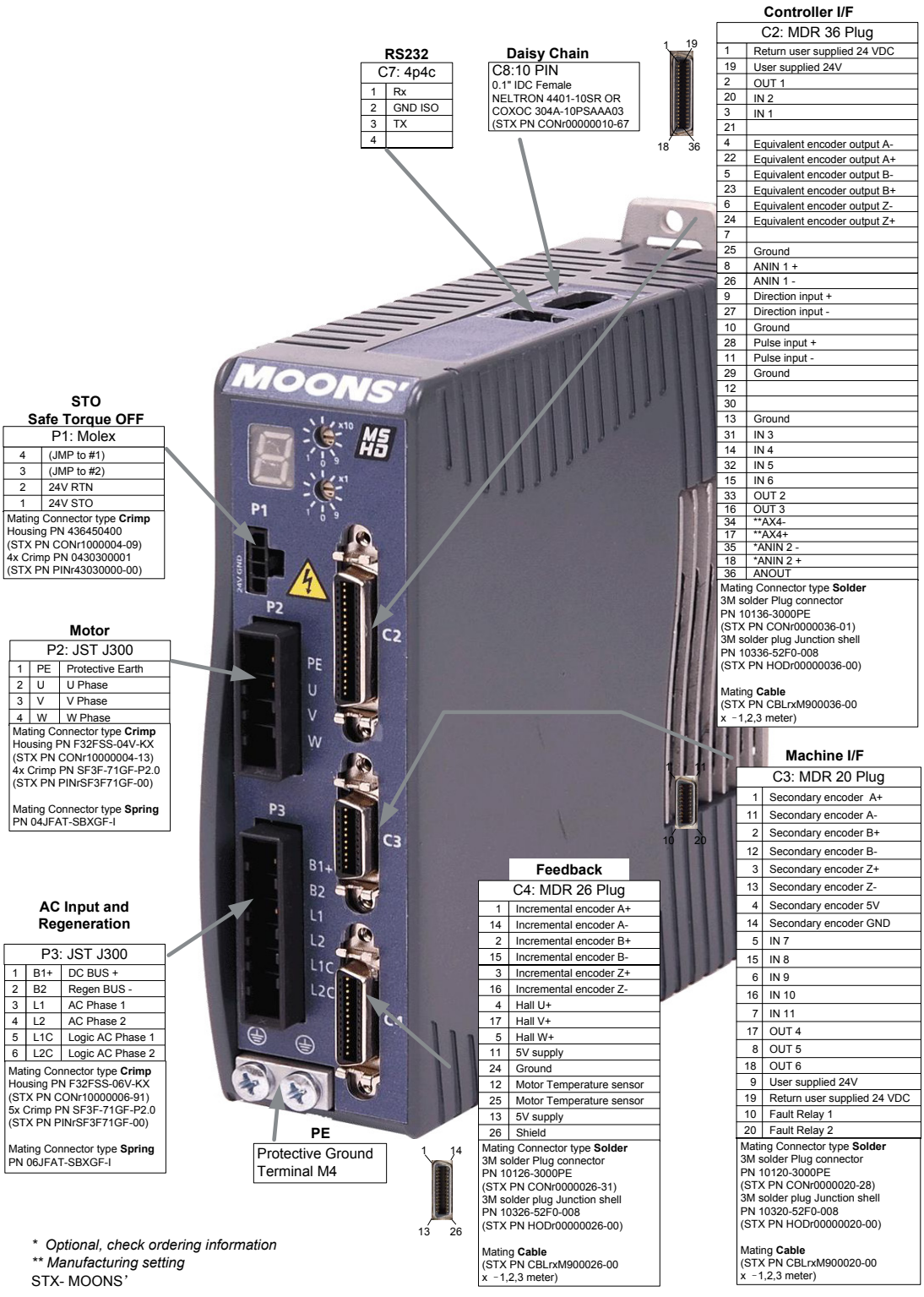
e108	Vbus Measure Circuit Fail	A failure occurred in the circuit that measures bus voltage.	Yes	Reset faults. If the fault persists, the drive probably needs repair. Contact technical support.
e109	Current-Sensors Offset Out-of-Range	The calculated offsets for the current sensors are out of range.	No	Reset faults. If the fault persists, the drive probably needs repair. Contact technical support.
F1	Drive Foldback	Drive average current exceeds rated drive continuous current. It occurs after the Foldback warning has occurred.	Yes	Check motor-drive sizing. This warning can occur if the drive is under-sized (under-powered) for the application.Check that the commutation angle is correct (i.e., commutation is balanced)
F2	Motor Foldback	Motor average current exceeds rated motor continuous current. It occurs after the Foldback warning has occurred.	Yes	Check the drive-motor sizing. This warning can occur if the motor is under-sized (under-powered) for the application.
H	Motor Over-Temperature	Either the motor has overheated, or the drive is not set up correctly for the motor temperature sensor.	Yes	Check that the drive is configured properly (using THERMODE, THERMTYPE, THERMTHRESH and THERMTIME), and that the motor temperature sensor is properly connected to the drive if needed.If the drive is configured and wired properly, check whether the motor is under-sized for the application.
j	Velocity Over-Speed Exceeded	Actual velocity exceeded 1.2 times the velocity limit. The velocity limit is set using VLIM.	Yes	Check that VLIM is set to match the application requirements. Using velocity loop tuning, check for excessive overshoot.
j1	Exceeded Maximum Position Error	The position error (PE) has exceeded the position error limit (PEMAX)	Yes	Change drive tuning to improve position tracking, or increase PEMAX to allow a greater position error.
n	STO Fault	The STO signal is not connected.	No	Check that the STO connector (P1) is wired correctly.
n1	Regen Over- Current	The preset current limit for regen current has been exceeded.	Yes	Increase the value of the regen resistor.
n2	Brake Fault		Yes	
o	Over-Voltage	The bus voltage exceeded the maximum value.	No	Check whether a regen resistor is required for the application.
o15	Plus 15V Out of Range	The internal +15 V supply is out of range.	Yes	The drive probably needs repair. Contact technical support.
o-15	Minus 15V Out of Range	The internal -15 V supply is out of range.	Yes	The drive probably needs repair. Contact technical support.
P	Over-Current	Over current at the drive output has been detected.The drive allows this fault to occur up to 3 times in succession. After 3 faults, the drive forces a delay of 1 minute before it can be reenabled.	No	Check for a short circuit on the motor connection. Check for excessive overshoot in the current loop.

r10	Sine Feedback Communication Fail	Communication problem between the drive and the EnDat encoder.	No	Check that the data and clock signals to the EnDat encoder are connected properly. The cable must be shielded.
r14	Sine Encoder Quadrature Fault	Mismatch between calculated and actual encoder quadrature information.	No	Check the feedback device wiring. Check that the correct encoder type (MENCTYPE) is selected.
r15	Sin/Cos Calibration Invalid	The sine/cosine calibration parameters are out of range. This fault is related to resolver and sine encoder feedback.	No	Re-execute the sine/cosine calibration process.
r16	Feedback 5V Over-Current	The current supplied by the drive on the 5V primary encoder supply has exceeded the preset current limit. The drive allows this fault to occur up to 3 times in succession. After 3 faults, the drive forces a delay of 1 minute before it can be reenabled.	No	The MSHD can source a maximum current of 250 mA to the primary encoder. Check for a short-circuit at the encoder. Check if the encoder is drawing more than the current limit.
r17	Secondary Feedback Index Break	Secondary encoder index line not connected.	Yes	Check whether the drive is configured for working with the index signal on the secondary encoder, and check if the index signal is connected.
r18	Secondary Feedback A/B Line Break	One of the secondary feedback signals is not connected.	Yes	Check that all signals from the secondary encoder are properly connected to the drive.
r19	Secondary Feedback 5V Over-Current	The preset current limit for current supplied by the drive on the 5 V secondary encoder supply has been exceeded.	No	The MSHD can source a maximum current of 250 mA to the secondary encoder. Check for a short-circuit at the encoder. Check if the encoder is drawing more than the current limit.
r20	Feedback Communication Error	Communication with the feedback device did not initialize correctly.	Yes	Check that the feedback device is wired correctly. Check that the correct encoder type (MENCTYPE) is selected.
r21	Sanyo Encoder Operational Fault	Communication with the Sanyo Denki feedback device did not initialize correctly.	No	Check that the feedback device is wired correctly. Check that the correct encoder type (MENCTYPE) is selected.
r23	Phase Find Failed	Commutation initialization has failed. This fault occurs in systems that do not have commutation information (e.g., Hall signals) in the motor feedback device.	No	Check whether the motor feedback type and the phase-finding parameters are set correctly for the application.
r24	Tamagawa Init Failed	The initialization process with the Tamagawa feedback device has failed.	No	Check that the wiring to the encoder is correct.
r25	Pulse & Direction Input Line Break	One of the Pulse & Direction signals is not connected.	No	Check that all signals to the P&D inputs are properly connected to the drive.

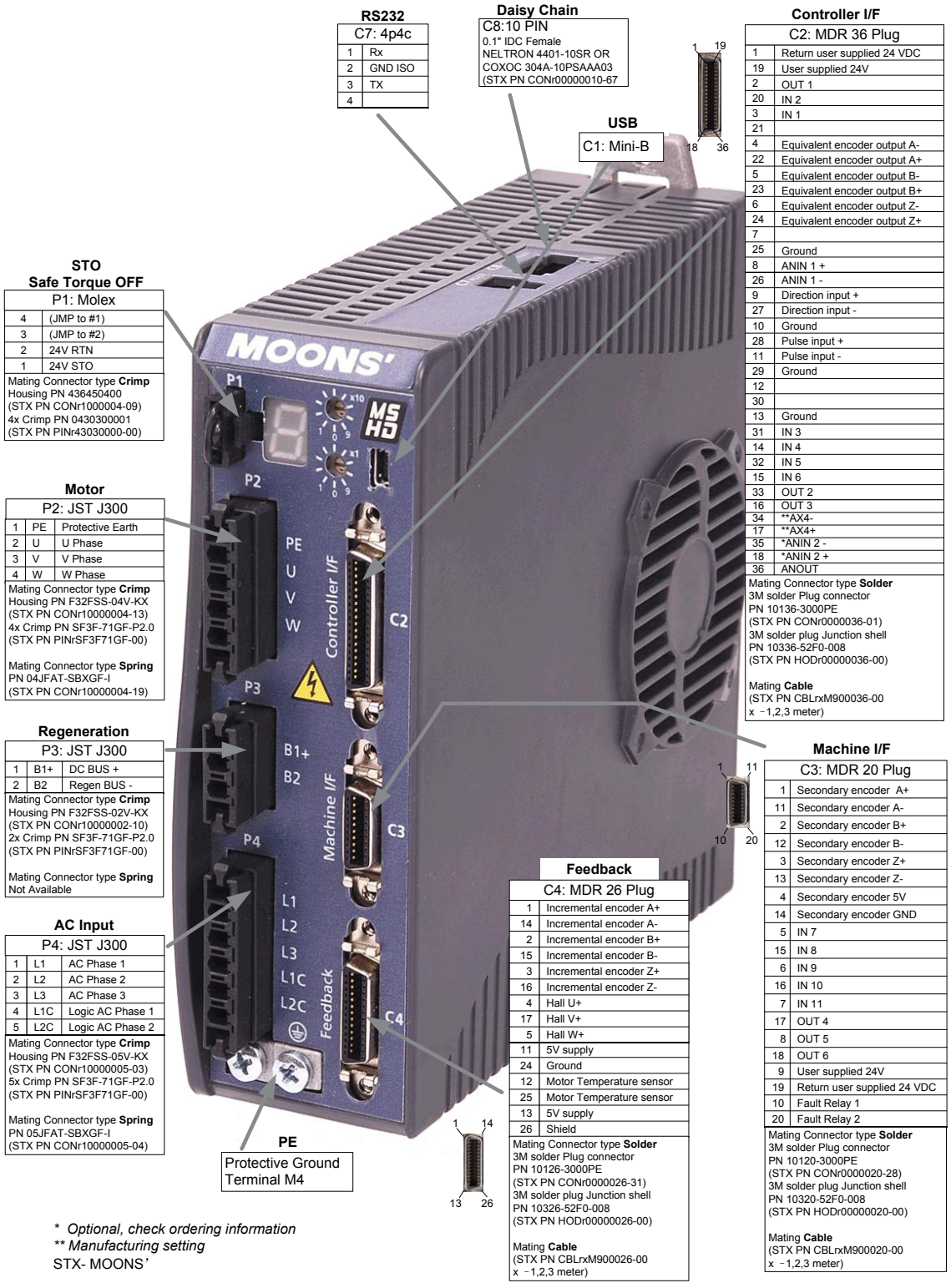
r26	Tamagawa Abs Operational Fault	Several faults are indicated by the feedback device and include one or more of the following: battery low/error, over-speed, counting error, multi-turn error	No	Check the battery voltage and feedback wiring. Make sure the motor did not move at a high velocity during encoder initialization.
r27	Motor Phases Disconnected	One of the motor phases is disconnected. The current of one of the motor phases is effectively zero for more than 160 electrical degrees while the current command is greater than 100.	Yes	Check the wiring of the motor phases.
r28	Resolver Initialization Failed	The drive could not detect the proper gain setting or sampling point for the sine/cosine signals.	No	Check resolver wiring and gain value.
r4	A/B Line Break	One of the primary feedback signals is not connected. This fault occurs in incremental encoder, resolver and sine encoder feedback types.	No	Check whether all signals from the primary feedback device are properly connected to the drive.
r5	Index Line Break	Encoder index line is not connected.	Yes	Check that the drive is configured for working with the index signal (using MENCTYPE), and check if the index signal is connected.
r6	Illegal Halls	The drive has detected either 000 or 111 state on the Hall feedback signals.	Yes	Check that the Hall signals are all properly connected. While turning the motor, read the Halls state (using HALLS) to see which signal is not connected. If the feedback type is Tamagawa, check that the feedback wiring is correct
r8	A/B Out of Range	Feedback analog signal is out of range. This fault is related to resolver and sine encoder feedback. The drive checks that the amplitudes of the sine and cosine signals are correct, based on the calculation sin2 + cos2 = 1	No	Check the amplitudes of the sine and cosine signals.
r9	Encoder Simulation Freq Too High	The computed equivalent encoder output frequency exceeds the upper limit for this signal, which is 4 MHz.	Yes	Check the parameters used for setting up the equivalent encoder output. If using a sine encoder, check the ENCOUTRES parameter settings.
t1	Power Stage Over-Temperature	The temperature on the power board has exceeded the preset limit.	Yes	Check if the ambient temperature exceeds the drive specification. Otherwise contact technical support.

t2	Power Module Over-Temperature	The temperature inside the integrated power module has exceeded the preset limit.	Yes	Check if the ambient temperature exceeds the drive specification. Otherwise contact technical support.
t3	Control Board Over-Temperature	The temperature on the control board has exceeded the preset limit.	Yes	Check if the ambient temperature exceeds the drive specification. Otherwise contact technical support.
u	Under-Voltage	The bus voltage is below the minimum value.	No	Check that the main AC voltage supply is connected to the drive and is switched on. The under-voltage limit can be read with the UVTHRESH command. Note: Fault if flashing; warning only if lit steadily

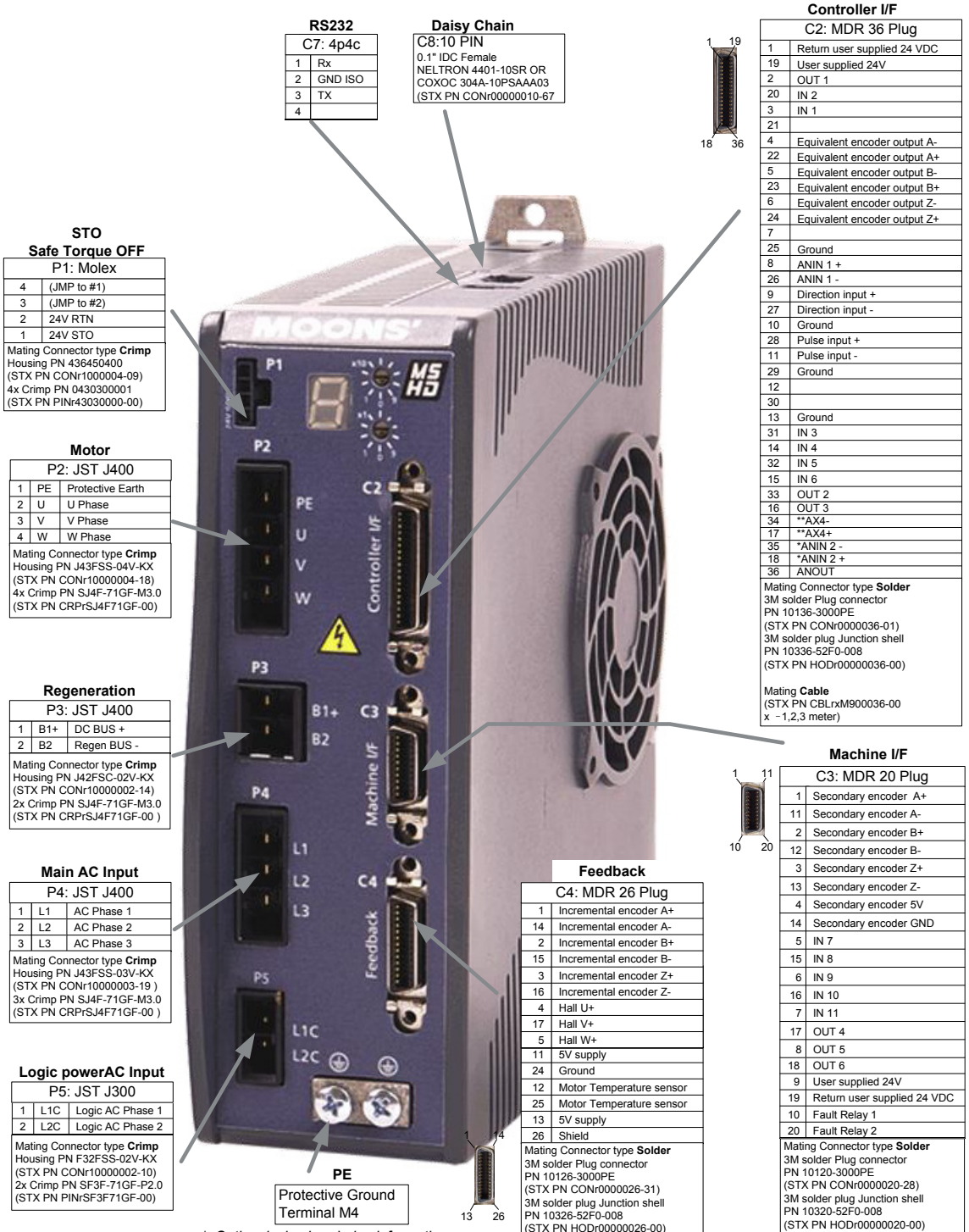
MSHD System Wiring - Pin Assignments



Pin Assignments on MSHD-1D5/MSHD-003



Pin Assignments on MSHD-4D5/MSHD-006



Pin Assignments on MSHD-008/MSHD-010/MSHD-013

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